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The effect of numbness on outcome from total knee replacement

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ABSTRACT

INTRODUCTION Some patients report continuing pain and functional limitations after total knee replacement (TKR). While numbness around the TKR scar is common, the impact of numbness is less clear. One particular activity that could be influenced by numbness is kneeling. The aim of this study was to explore the impact of numbness around TKR scars on health related quality of life and kneeling ability.

METHODS Fifty-six patients were recruited one year after primary TKR. Sensation around the knee was assessed through patient self-reporting, monofilament testing and vibration, and patients' distress was measured on a visual analogue scale. Patient reported outcome measures (PROMs) including the Western Ontario and McMaster Universities (WOMAC®) index, the Knee injury and Osteoarthritis Outcome Score (KOOS), the painDETECT® (Pfizer, Berlin, Germany) questionnaire and the EQ-5D™ (EuroQol, Rotterdam, Netherlands) questionnaire were used. Participants were also asked about kneeling ability.

RESULTS While 68% of patients reported numbness around their TKR scar, there was no statistically significant correlation between numbness and distress at numbness (self-report: 0.23, $p=0.08$; monofilament: 0.15, $p=0.27$). Furthermore, numbness did not correlate significantly with joint specific PROMs (WOMAC®: 0.21, $p=0.13$; KOOS: 0.18, $p=0.19$). However, difficulty with kneeling did correlate with both self-reported numbness (0.36, $p=0.020$) and worse PROM scores (WOMAC® pain subscale: 0.62, $p<0.001$; KOOS: 0.64, $p<0.001$).

CONCLUSIONS Numbness after knee replacement is common but is not associated with worse patient reported outcomes.

KEYWORDS

Numbness – Total knee replacement – Health related quality of life – Kneeling

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In 2015 over 88,000 primary total knee replacement (TKR) procedures were performed in England, Wales and Northern Ireland.¹ TKR is usually an effective surgical intervention for providing relief from chronic knee pain and disability although some patients report continuing pain and functional limitations after surgery.²

Commonly assessed patient reported outcomes after TKR include pain, function, general health and overall satisfaction with the outcome of surgery. Despite between 71% and 100% of patients experiencing numbness around their TKR scar,^{3–9} the consequences of this complication have received little attention, perhaps in part because the area of numbness typically regresses during the first two years following surgery.^{4,6,7,9–11}

Factors affecting the area and the duration of sensory loss around the incision are not entirely clear. Some studies have found that the size of the numb area is related to the length of the scar^{6,7,11} or longer tourniquet time⁷ but others have found no association.⁹ A more lateral incision has been associated with reduced numbness^{3,7,12,13} while a study comparing the medial parapatellar approach with a midline approach showed no difference in the area of numbness.¹⁰

As a result, the evidence is lacking to develop guidance on the prevention of postoperative numbness.

Although previous research has established that numbness is a common occurrence after TKR, the impact of numbness is less clear. Variability has been reported regarding the extent to which patients notice the numbness and are concerned about it.^{5,6} Only two studies have investigated the association between numbness and patient reported outcome measures (PROMs). One found numbness was not associated with the Oxford knee score⁸ while the other found it did correlate with the Western Ontario and McMaster Universities (WOMAC®) osteoarthritis index as well as the Knee injury and Osteoarthritis Outcome Score (KOOS).¹⁵ Consequently, although numbness around the TKR scar is common, the effects of sensory loss on knee specific and health related quality of life remain unclear.

One particular activity that could potentially be influenced by numbness is kneeling. Kneeling following TKR can be difficult, with studies reporting 12–87% of patients finding it extremely difficult or impossible to kneel.^{8,14–17} However, kneeling can be important to patients. For example, a study of Korean women found that 53.9% reported kneeling for

religious reasons before their TKR.¹⁸ A review of the literature also revealed a number of studies correlating increased knee osteoarthritis with occupations involving kneeling.¹⁹

Patients in some studies reported that they avoided kneeling because of their own uncertainties or recommendations from healthcare professionals.^{14,15,20} Although many patients do not even attempt to kneel,²⁰ in studies that encouraged kneeling under supervision, many were able to do so.^{14,20} Previous research has suggested that patients with a smaller area of numbness and greater range of motion find kneeling easier^{11,20} but study results are inconsistent.¹⁵ The aim of this study was therefore to explore the impact of numbness around TKR scars on health related quality of life and kneeling ability.

Methods

Ethical approval for the study was obtained from the local National Health Service research ethics committee. All participants provided informed written consent. Individuals were eligible to participate if they had undergone a primary TKR at least one year previously. Participants were recruited by approaching consecutive patients who were attending a follow-up appointment for another research study (APEX [Arthroplasty Pain Experience] trial).²¹ Those with diabetic neuropathy and those who had undergone revision surgery were excluded. Computerised operation notes were examined for surgical details including surgical approach and tourniquet time.

Assessment of numbness

Sensation around the knee was assessed in three ways: self-reporting, monofilament testing (Bailey Instruments, Manchester, UK) and vibration testing (VibraTip™; McCallan Medical, Nottingham, UK). For each method, the area of numbness was recorded on cling film that was placed over the knee. The cling film was then fixed to 160g/m² card with adhesive spray so the areas could be cut out and quantified as a series of masses using an analytical balance with 0.1mg resolution.

The order of testing was randomised by sequential selection of envelopes containing one of the six possible combinations of tests. Details of the three assessment methods are given below.

Self-report: Patients sat on an examination couch, with their legs extended, and mapped the area of skin numbness using their fingertips.

Monofilament: Numbness in the skin area surrounding the scar was assessed at approximately 1cm intervals with a monofilament. Before testing with a monofilament, patients were asked to close their eyes. A 10g Semmes-Weinstein monofilament was applied perpendicular to the skin and pressure was applied until it buckled. This was repeated three times and patients were asked to say 'yes' each time they felt skin pressure from the monofilament.

Vibration: This was tested with the VibraTip™ device, which contains a microvibrating motor driven by a button cell that provides a specific vibration stimulus of reproducible amplitude with high face validity.²² Patients were asked

to close their eyes and say whether they felt a vibration on 'touch 1' or 'touch 2', when only one stimulus involved vibration.

Distress caused by numbness

Patients were asked to rate their numbness and the distress this caused them on a 100mm visual analogue scale (VAS).

Assessment of kneeling ability

Patients were asked to kneel on a thick silicone mat with washable pigment so the area of contact could be measured and quantified. They were also asked about kneeling and difficulties experienced when kneeling.

Health related quality of life

PROMs used to assess health related quality of life included the WOMAC® index,²³ the knee related quality of life subscale from the KOOS questionnaire,²⁴ the painDETECT® (Pfizer, Berlin, Germany) questionnaire²⁵ and the EQ-5D™ (EuroQol, Rotterdam, Netherlands) questionnaire.²⁶

The WOMAC® index is a 24-item disease specific measure that produces separate subscores for the severity of pain (0–20), stiffness (0–20) and physical function (0–68). The KOOS knee related quality of life subscale consists of four items that assess the respondents' confidence and awareness of their knee. The painDETECT® questionnaire is a screening tool for neuropathic pain. It comprises nine questions about pain experienced over the previous four weeks, rated from 0 to 5. A total score of ≤12 indicates that the pain is unlikely to have a neuropathic component and a score of ≥19 indicates that the pain is likely to be neuropathic in origin. The EQ-5D™ tool is a standardised health related quality of life questionnaire comprising five dimensions: mobility, self-care, usual activities, pain or discomfort and anxiety or depression.

Statistical analysis

In order to avoid problems with potentially non-parametric data, Spearman's correlation coefficient was used throughout to compare PROMs, assessment of numbness, scar length, tourniquet duration, difficulty in kneeling, reported numbness and distress caused by numbness. A power calculation revealed that in order to enable valid analysis (with a power of 80% and 5% statistical significance) of any correlation between sensory loss and standardised assessments of function and quality of life of 0.36 or more, 56 complete datasets were required.

Results

A total of 56 participants were recruited to the study. The mean age of participants was 70 years (range: 53–87 years) and 28 (50%) were female. All participants were assessed by one clinician (JB) within three months of the one-year anniversary of their TKR.

Numbness data were available for all patients using the self-report method and for 98% (55/56) using the monofilament but for only 35% (20/56) using the VibraTip™ as many

were unable to detect vibration anywhere on their knee. All patients completed the health related quality of life PROMs. Data regarding surgical details such as tourniquet duration were complete for 75% of patients (42/56).

Numbness

On examination, 68% of patients (38/56) self-reported some degree of numbness around their TKR scar while 56% (31/55) had numbness when tested by monofilament. Only 36% (20/56) were able to detect vibration anywhere around their scar (although they were able to detect it on their hand as a control).

Self-reported numbness correlated with monofilament assessed numbness (0.45, $p<0.0001$) and VibraTip™ assessed numbness (0.51, $p=0.021$). The strongest correlation was between monofilament numbness and VibraTip™ numbness (0.70, $p=0.001$).

In 23% of patients (13/56), no numbness was reported on the day and 18% (10/56) reported having no numbness in the previous four weeks. Fifty-six per cent of the patients who had experienced numbness (26/46) reported no distress as a result of their numbness. The median severity of numbness and distress caused by the numbness, both measured on a VAS, is shown in Table 1.

Correlations between measures of numbness in clinic and VAS ratings are displayed in Table 2. All correlations were statistically significant at the 5% level except those between distress at numbness and clinical measures of numbness.

Correlations between health related quality of life scores and measures of numbness are shown in Table 3. The only statistically significant correlations were between the pain-DETECT® score and self-reported numbness (0.28, $p=0.037$), and between the EQ-5D™ and numbness assessed by VibraTip™ (0.55, $p=0.012$).

Table 1 Severity of self-reported numbness measured on a 100mm VAS

	Median VAS score
Numbness that day	20 (range: 0–95)
Numbness over the previous 4 weeks	19.5 (range: 0–97)
Distress at numbness	1 (range: 0–78)
VAS = visual analogue scale	

Scar length

The most common surgical approach was the medial parapatellar (47/56), followed by the subvastus (6/56), midvastus (2/56) and anteromedial approach (1/56). The mean scar length was 172mm (range: 125–284mm), and there was no statistically significant correlation between length of scar and self-reported numbness (-0.03 , $p=0.82$), monofilament assessed numbness (-0.04 , $p=0.77$) or VibraTip™ assessed numbness (0.17, $p=0.50$).

Tourniquet duration

The mean tourniquet duration was 75 minutes (range: 33–133 minutes). There was no statistically significant correlation between tourniquet duration and self-reported numbness (0.23, $p=0.14$), monofilament assessed numbness (0.15, $p=0.35$) or VibraTip™ assessed numbness (0.36, $p=0.18$, $n=16$).

Kneeling

In the four weeks prior to completing the questionnaire, 63% of patients (35/56) had needed to kneel but 29% of these (10/35) had rated this as impossible. Only 14% (8/56) were able to kneel as easily as they would like. Difficulty in kneeling correlated with self-reported numbness (-0.36 , $p=0.020$) and VibraTip™ assessed numbness (-0.62 , $p=0.014$, $n=15$) but did not correlate significantly with monofilament assessed numbness (-0.07 , $p=0.68$). Kneeling ability correlated with all PROMs (Table 4).

Only 30% of patients (17/56) agreed to kneel during the research appointment. Reasons given for not wanting to attempt kneeling included pain, stiffness, having both knees affected, reduced range of movement and numbness.

Discussion

While 68% of patients in our study reported numbness around their TKR scar, no significant correlation was found between numbness and distress at numbness. Furthermore, numbness was not significantly correlated with joint specific PROMs. However, difficulty in kneeling did correlate with both self-reported numbness and worse PROM scores.

Our study has a number of strengths. Both objective monofilament assessed numbness and self-reported numbness was analysed as well as the effect on health related quality of life. Our study adds to the current literature as the two previous studies on numbness around TKR scars investigated either self-reported numbness⁸ or

Table 2 Spearman's rank correlation coefficients for correlation between area of numbness and severity/distress at numbness

	Self-report ($n=56$)	Monofilament ($n=55$)	VibraTip™ ($n=20$)
Severity of numbness that day	0.67 ($p<0.0001$)	0.50 ($p<0.0001$)	0.53 ($p=0.017$)
Severity of numbness over previous 4 weeks	0.62 ($p<0.001$)	0.49 ($p<0.0001$)	0.53 ($p=0.017$)
Distress at numbness	0.23 ($p=0.08$)	0.15 ($p=0.27$)	0.13 ($p=0.58$)

Table 3 Spearman's rank correlation coefficients for correlation between measures of knee function pain and health related quality life and measures of numbness

	WOMAC [®] pain	WOMAC [®] stiffness	WOMAC [®] function	KOOS	painDETECT [®]	EQ-5D TM
Self-report (n=56)	0.21 (p=0.13)	0.10 (p=0.48)	0.20 (p=0.14)	0.18 (p=0.19)	0.28 (p=0.037)	-0.17 (p=0.22)
Monofilament (n=55)	-0.01 (p=0.97)	0.02 (p=0.88)	-0.09 (p=0.52)	-0.08 (p=0.55)	-0.07 (p=0.96)	0.20 (p=0.14)
VibraTip TM (n=20)	-0.33 (p=0.16)	-0.13 (p=0.60)	-0.35 (p=0.14)	-0.31 (p=0.18)	-0.13 (p=0.57)	0.55 (p=0.012)

Table 4 Spearman's rank correlation coefficients for correlation between patient reported outcome measures (PROMs) and kneeling ability

PROMs	Correlation
WOMAC [®] pain	0.62 (p<0.001)
WOMAC [®] stiffness	0.48 (p=0.002)
WOMAC [®] function	0.59 (p<0.001)
KOOS	0.64 (p<0.001)
painDETECT [®]	0.55 (p<0.001)
EQ-5D TM	-0.73* (p<0.001)

*A higher score for EQ-5DTM indicates a better quality of life while a higher score for the other PROMs indicates a worse quality of life.

monofilament assessed numbness¹⁵ but no study has included both assessment methods.

The proportion of patients in our study with self-reported numbness around their TKR scar (68%) is similar to that in other studies,⁵⁻⁹ and distress at numbness varies between 8%⁵ and 20%⁶ in the literature. However, there have been no other studies that have calculated a correlation between numbness and distress.

In our study, numbness did not correlate significantly with joint specific PROMs (including the WOMAC[®] score and KOOS) or health related quality of life (as measured by the EQ-5DTM). A study of 49 TKRs also found no correlation with Oxford knee score or patient satisfaction.⁸ Although a study comparing midline with anterolateral skin incisions found that a smaller area of monofilament assessed numbness did correlate with better WOMAC[®] scores and KOOS results at one year, their correlations were weak with wide confidence intervals (WOMAC[®]: $r^2=-0.104$, 95% confidence interval [CI]: -0.309–0.001; KOOS: $r^2=-0.166$, 95% CI: -0.426–0.007).¹⁵

Our study found that although self-reported numbness did correlate weakly with the painDETECT[®] score, monofilament assessed numbness did not. The differences between the two assessment methods may be due to psychological factors; one study observed that patients were more than three times more likely to report numbness if it was discussed during the consent process.²⁷

For our patients, difficulty in kneeling correlated moderately with worse PROM scores. A study of 206 TKRs also found a significant moderate correlation between kneeling ability and WOMAC[®] score at 1 and 2 years²⁸ but other studies found no correlation.^{8,15} This may be because patients have adapted to perform various activities without kneeling prior to their surgery so difficulty in kneeling postoperatively does not impact on their PROM scores.

The results of our study showed a weak correlation between difficulty in kneeling and greater self-reported numbness but not monofilament assessed numbness. Of the other studies considering kneeling ability, only one assessed numbness around the TKR scar but it did not correlate numbness and kneeling ability.⁸ However, supervision of kneeling by clinicians has been shown to improve patients' confidence in their kneeling ability²⁰ so any association with self-reported numbness could diminish.

It is a limitation of our study that we did not control for confounding factors. For example, range of movement may have contributed to associations between difficulty in kneeling and worse PROM scores. Other studies have shown correlations between difficulty in kneeling and a reduced range of movement.^{16,20,28}

Despite this, our findings that numbness around TKR scars does not significantly correlate with distress or joint specific PROM scores and health related quality of life should allow clinicians to reassure patients about the impact of any numbness they may experience. Difficulty in kneeling following TKR is a complex problem and further research is needed into associations with numbness, PROMs and range of movement. Comparing kneeling ability prior to TKR with postoperative ability may provide information about how difficulty in kneeling affects PROMs. The effect of interventions to improve confidence in kneeling ability on PROMs could also be explored.

Conclusions

This study found no statistically significant association between numbness around TKR scars and joint specific PROMs. However, there was an association between self-reported numbness and difficulty in kneeling. Patients who could not kneel reported worse PROM scores. Although larger studies might identify factors that contribute to impaired kneeling and PROMs more clearly, our study suggests that numbness after knee replacement is not associated with worse patient reported outcomes.

Conflict of interest

AWB receives research support from Stryker as a principal investigator and is a board member for the European Orthopaedic Research Society. AL is the inventor of the VibraTip™ device.

References

1. National Joint Registry. Knees – Primary Procedures – Patient Characteristics. <http://www.njrreports.org.uk/knees-primary-procedures-patient-characteristics> (cited January 2017).
2. Beswick AD, Wylde V, Gooberman-Hill R *et al*. What proportion of patients report long-term pain after total hip or knee replacement for osteoarthritis? A systematic review of prospective studies in unselected patients. *BMJ Open* 2012; **2**: e000435.
3. Borley NR, Edwards D, Villar RN. Lateral skin flap numbness after total knee arthroplasty. *J Arthroplasty* 1995; **10**: 13–14.
4. Johnson DF, Love DT, Love BR, Lester DK. Dermal hypoesthesia after total knee arthroplasty. *Am J Orthop* 2000; **29**: 863–866.
5. Hassaballa M, Vale T, Weeg N, Hardy JR. Kneeling requirements and arthroplasty surgery. *Knee* 2002; **9**: 317–319.
6. Hopton BP, Tommichan MC, Howell FR. Reducing lateral skin flap numbness after total knee arthroplasty. *Knee* 2004; **11**: 289–291.
7. Subramanian S, Lateef H, Massraf A. Cutaneous sensory loss following primary total knee arthroplasty. A two years follow-up study. *Acta Orthop Belg* 2009; **75**: 649–653.
8. Sharkey PF, Miller AJ. Noise, numbness, and kneeling difficulties after total knee arthroplasty: is the outcome affected? *J Arthroplasty* 2011; **26**: 1,427–1,431.
9. Liu H, Wen LC, Cao YP *et al*. Dermal hypoesthesia after total knee arthroplasty. *Beijing Da Xue Xue Bao* 2012; **44**: 882–886.
10. Sundaram RO, Ramakrishnan M, Harvey RA, Parkinson RW. Comparison of scars and resulting hypoesthesia between the medial parapatellar and midline skin incisions in total knee arthroplasty. *Knee* 2007; **14**: 375–378.
11. Hassaballa M, Artz N, Weale A, Porteous A. Alteration in skin sensation following knee arthroplasty and its impact on kneeling ability: a comparison of three common surgical incisions. *Knee Surg Sports Traumatol Arthrosc* 2012; **20**: 1983–1987.
12. Berg P, Mjöberg B. A lateral skin incision reduces peripatellar dysaesthesia after knee surgery. *J Bone Joint Surg Br* 1991; **73**: 374–376.
13. Laffosse JM, Potapov A, Malo M *et al*. Hypesthesia after anterolateral versus midline skin incision in TKA: a randomized study. *Clin Orthop Relat Res* 2011; **469**: 3,154–3,163.
14. Schai PA, Gibbon AJ, Scott RD. Kneeling ability after total knee arthroplasty. Perception and reality. *Clin Orthop Relat Res* 1999; **367**: 195–200.
15. Palmer SH, Servant CT, Maguire J *et al*. Ability to kneel after total knee replacement. *J Bone Joint Surg Br* 2002; **84**: 220–222.
16. Hassaballa MA, Porteous AJ, Newman JH, Rogers CA. Can knees kneel? Kneeling ability after total, unicompartmental and patellofemoral knee arthroplasty. *Knee* 2003; **10**: 155–160.
17. Scott CE, Bugler KE, Clement ND *et al*. Patient expectations of arthroplasty of the hip and knee. *J Bone Joint Surg Br* 2012; **94**: 974–981.
18. Kim TK, Kwon SK, Kang YG *et al*. Functional disabilities and satisfaction after total knee arthroplasty in female Asian patients. *J Arthroplasty* 2010; **25**: 458–464.
19. Jensen LK, Eenberg W. Occupation as a risk factor for knee disorders. *Scand J Work Environ Health* 1996; **22**: 165–175.
20. Hassaballa MA, Porteous AJ, Newman JH. Observed kneeling ability after total, unicompartmental and patellofemoral knee arthroplasty: perception versus reality. *Knee Surg Sports Traumatol Arthrosc* 2004; **12**: 136–139.
21. Wylde V, Lenguerrand E, Gooberman-Hill R *et al*. Effect of local anaesthetic infiltration on chronic postsurgical pain after total hip and knee replacement: the APEX randomised controlled trials. *Pain* 2015; **156**: 1,161–1,170.
22. Levy A. Preliminary data on VibraTip®, a new source of standardised vibration for bedside assessment of peripheral neuropathy. *Br J Diabetes Vasc Dis* 2010; **10**: 284–286.
23. Bellamy N, Buchanan WW, Goldsmith CH *et al*. Validation study of WOMAC: a health status instrument for measuring clinically important patient relevant outcomes to antirheumatic drug therapy in patients with osteoarthritis of the hip or knee. *J Rheumatology* 1988; **15**: 1,833–1,840.
24. Roos EM, Roos HP, Lohmander LS *et al*. Knee injury and osteoarthritis Outcome Score (KOOS) – development of a self-administered outcome measure. *J Orthop Sports Phys Ther* 1998; **28**: 88–96.
25. Freynhagen R, Baron R, Gockel U, Tölle T. painDETECT: a new screening questionnaire to identify neuropathic components in patients with back pain. *Curr Med Res Opin* 2006; **22**: 1,911–1,920.
26. Busschbach JJ, McDonnell J, Essink-Bot ML, van Hout BA. Estimating parametric relationships between health description and health valuation with an application to the EuroQol EQ-5D. *J Health Econ* 1999; **18**: 551–571.
27. Black R, Green C, Sochart D. Postoperative numbness of the knee following total knee arthroplasty. *Ann R Coll Surg Engl* 2013; **95**: 565–568.
28. Artz NJ, Hassaballa MA, Robinson JR *et al*. Patient reported kneeling ability in fixed and mobile bearing knee arthroplasty. *J Arthroplasty* 2015; **30**: 2,159–2,163.